

LISTING OF THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (Previously Presented)

An ultrasonic bonding method for bonding a material to a bonding surface by the application of ultrasonic vibration, comprising the steps of:

clamping two side faces of the material by a clamping motion in the direction of ultrasonic vibration respectively with an application member that applies a predetermined ultrasonic vibration, and a clamping member that performs said clamping motion and is synchronously vibrated in the same direction as that of the application member and at an amplitude substantially equal to that of the application member by the predetermined ultrasonic vibration transmitted from the application member through the material, and

pressing the material against the bonding surface so as to bond the material to the bonding surface.

Claim 2 (Previously Presented)

An ultrasonic bonding method for bonding a material to a bonding surface by the application of ultrasonic vibration, comprising the steps of:

clamping two side faces of the material in the direction of ultrasonic vibration respectively with an application member that applies a predetermined ultrasonic vibration, and a clamping member that is synchronously vibrated in the same direction as that of the application member and at an amplitude substantially equal to that of the application member by the predetermined ultrasonic vibration transmitted from the application member through the material, and

pressing the material against the bonding surface so as to bond the material to the bonding surface; and,

wherein the material is bonded to the bonding surface while urging the clamping-member at a node of the clamping member, in such a direction that the clamping member presses the

material against the application member.

Claim 3 (Original)

An ultrasonic bonding method according to claim 1, wherein a predetermined pressing load is applied to the application member in a direction so as to press the material against the bonding surface, during the application of the ultrasonic vibration.

Claim 4 (Original)

An ultrasonic bonding method according to claim 1, wherein the opposing distance between the material and the bonding surface is controlled, during the application of the ultrasonic vibration.

Claim 5 (Original)

An ultrasonic bonding method according to claim 1, wherein the resonant frequency of the clamping member is shifted from the frequency of the ultrasonic vibration so that the amplitude of the clamping member is substantially equal to the amplitude of the application member.

Claim 6 (Previously Presented)

An ultrasonic bonding device for bonding a material to a bonding surface by the application of ultrasonic vibration, the device comprising:

a vibrator for producing ultrasonic vibration;

an application member that supports one side face of the material in the direction of the ultrasonic vibration and that applies the ultrasonic vibration produced by the vibrator to the material;

a clamping member that supports the other side face of the material and performs a clamping motion in the direction of the ultrasonic vibration and that is synchronously vibrated in the same direction as that of the application member and at an amplitude substantially equal to

that of the application member by the ultrasonic vibration transmitted from the application member through the material; and

an urging member which urges the clamping member in said direction so as to clamp the material in cooperation with the application member,

wherein the application member, the clamping member, and the material vibrate together in the direction of the ultrasonic vibration.

Claim 7 (Previously Presented)

An ultrasonic bonding device for bonding a material to a bonding surface by the application of ultrasonic vibration, the device comprising:

a vibrator for producing ultrasonic vibration;

an application member that supports one side face of the material in the direction of the ultrasonic vibration and that applies the ultrasonic vibration produced by the vibrator to the material;

a clamping member that supports the other side face of the material in the direction of the ultrasonic vibration and that is synchronously vibrated in the same direction as that of the application member and at an amplitude substantially equal to that of the application member by the ultrasonic vibration transmitted from the application member through the material; and

an urging member which urges the clamping member in a direction so as to clamp the material in cooperation with the application member,

wherein the application member, the clamping member, and the material vibrate together in the direction of the ultrasonic vibration; and,

wherein the urging member is connected to a node of the clamping member.

Claim 8 (Original)

An ultrasonic bonding device according to claim 6, wherein the application member has a first face for supporting the one side face of the material in the direction of the ultrasonic vibration, and a second face substantially parallel to the bonding surface to support an upper surface of the material, and the second face has a suction hole for drawing the material.

Claim 9 (Previously Presented)

An ultrasonic bonding device for bonding a material to a bonding surface by the application of ultrasonic vibration, the device comprising:

a vibrator for producing ultrasonic vibration;

an application member that supports one side face of the material in the direction of the ultrasonic vibration and that applies the ultrasonic vibration produced by the vibrator to the material;

a clamping member that supports the other side face of the material in the direction of the ultrasonic vibration and that is synchronously vibrated in the same direction as that of the application member and at an amplitude substantially equal to that of the application member by the ultrasonic vibration transmitted from the application member through the material; and

an urging member which urges the clamping member in a direction so as to clamp the material in cooperation with the application member,

wherein the application member, the clamping member, and the material vibrate together in the direction of the ultrasonic vibration; and, further comprising:

a load control member which applies a controlled downward pressing load to the application member.

Claim 10 (Previously Presented)

An ultrasonic bonding device for bonding a material to a bonding surface by the application of ultrasonic vibration, the device comprising:

a vibrator for producing ultrasonic vibration;

an application member that supports one side face of the material in the direction of the ultrasonic vibration and that applies the ultrasonic vibration produced by the vibrator to the material;

a clamping member that supports the other side face of the material in the direction of the ultrasonic vibration and that is synchronously vibrated in the same direction as that of the application member and at an amplitude substantially equal to that of the application member by the ultrasonic vibration transmitted from the application member through the material; and

an urging member which urges the clamping member in a direction so as to clamp the material in cooperation with the application member,

wherein the application member, the clamping member, and the material vibrate together in the direction of the ultrasonic vibration; and, further comprising:

a position control member which controls the amount of downward movement of the application member.

Claim 11 (Currently Amended)

An ultrasonic bonding device according to any one of claims 7, 9 and 10 ~~6-10~~, wherein the application member is an ultrasonic horn shaped like a substantially symmetric inverted triangle, the vibrator is mounted at at least one of the right and left vertexes of the ultrasonic horn, and an output section is provided at a bottom vertex of the ultrasonic horn to apply ultrasonic vibration to the material, and

wherein, when an ultrasonic vibration substantially parallel to an oblique side adjoining said at least one of the right and left vertexes of the ultrasonic horn is input from the vibrator, a horizontal ultrasonic vibration is output from the output section.

Claim 12 (New)

An ultrasonic bonding device for bonding a material to a bonding surface by the application of ultrasonic vibration, the device comprising:

a vibrator for producing ultrasonic vibration;

an application member that supports one side face of the material in the direction of the ultrasonic vibration and that applies the ultrasonic vibration produced by the vibrator to the material;

a clamping member that supports the other side face of the material and performs a clamping motion in the direction of the ultrasonic vibration and that is synchronously vibrated in the same direction as that of the application member and at an amplitude substantially equal to that of the application member by the ultrasonic vibration transmitted from the application member through the material; and

an urging member which urges the clamping member in said direction so as to clamp the material in cooperation with the application member,

wherein the application member, the clamping member, and the material vibrate together in the direction of the ultrasonic vibration,

wherein the application member is an ultrasonic horn shaped like a substantially symmetric inverted triangle, the vibrator is mounted at at least one of the right and left vertexes of the ultrasonic horn, and an output section is provided at a bottom vertex of the ultrasonic horn to apply ultrasonic vibration to the material, and

wherein, when an ultrasonic vibration substantially parallel to an oblique side adjoining said at least one of the right and left vertexes of the ultrasonic horn is input from the vibrator, a horizontal ultrasonic vibration is output from the output section.

Claim 13 (New)

An ultrasonic bonding device according to claim 12, wherein the application member has a first face for supporting the one side face of the material in the direction of the ultrasonic vibration, and a second face substantially parallel to the bonding surface to support an upper surface of the material, and the second face has a suction hole for drawing the material.